CLAIMS

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. A process for separating uranium and transuranic metals from spent metallic nuclear fuel and refining the uranium to its metallic state, the process comprising:

a) continuously transporting spent fuel to and through a molten electrolyte salt bath;

b) oxidizing the transported uranium and transuranic metals at an anode;

c) reducing the oxidized uranium ions to metallic uranium at a cathode; and

d) removing the metallic uranium from the cathode.

2. The process as recited in claim 1 wherein the cathode is immersed in the molten electrolyte salt bath.

3. The process as recited in claim 1 wherein the cathode comprises a right cylindrical drum horizontally mounted in the containment vessel

4. The process as recited in claim 1 wherein the anode comprises a containment vessel, the spent fuel, and a conveyor belt, wherein the conveyor belt is in close spatial relation to the containment vessel and to the cathode.

5. The process as recited in claim 4 wherein the conveyer belt is a segmented chain belt that contains perpendicular weirs.

6. The process as recited in claim 1 wherein the molten electrolyte is comprised of a eutectic mixture of lithium chloride (LiCl) and potassium chloride (KCl) salts, and uranium chloride (UCl_3).

7. The process as recited in claim 1 wherein there is electrical communication between the anode and cathode via the electrolyte.

8. The process as recited in claim 7 wherein the electrolyte facilitates the electrical communication.

9. A device for electrorefining uranium and other metals contained in spent metallic nuclear fuels, the device comprising:

a) a means for oxidizing the uranium and other metals;

b) a means for continuously transporting spent metallic nuclear fuel to the oxidizing means;

c) a means for reducing uranium (III), U^{3+}, ions while keeping the other metals oxidized;

d) a means for isolating the reduced uranium from the other metals; and

e) a means for receiving inert material remaining after the oxidation and reduction.

10. The device as recited in claim 9 wherein the means of transport of spent nuclear fuel to a site of oxidation is a segmented chain belt in electrical communication with a containment vessel.

11. The device as recited in claim 9 wherein the means for oxidation of uranium metal and transuranic metals is an anode comprising:

a) a containment vessel;

b) an electrolytic salt bath residing in said vessel; and

c) the transport means.

12. The device as recited in claim 9 wherein the means for reduction of uranium (III), U^{3+}, ions is a cathode in electrical communication with an electrolytic salt bath.

13. The device as recited in claim 9 further comprising a means for cleaning the transport means, comprising a second salt bath adapted to receive the segmented chain belt.

14. The device as recited in claim 9 wherein the means for isolating the uranium is a mechanical scraping blade contacting the cathode, and wherein the blade is situated remote from the electrolytic salt bath.

15. The device as recited in claim 9 wherein the means of oxidation and the means of reduction move in opposite directions.

16. The device as recited in claim 15 wherein the oxidation means and reduction means move simultaneously.

17. The device as recited in claim 9 wherein material comprising the means of transport, means of reduction, and means of oxidation is a heat tolerant material selected from the group consisting of low-carbon steel, ferritic stainless steel, stainless steel, and alloys thereof.

18. The device as recited in claim 14 wherein the scraper is made of a material selected from the group consisting of tool steel, silicon carbide, and tungsten carbide.

19. The device as recited in claim 17 wherein the melting point (mp) temperatures of the heat-tolerant materials are above the temperatures of the salt baths.